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ABSTRACT

The mission of the Deputy Assistant Secretary for Field Operations and International Programs is to plan, direct, execute, integrate and control field programs, international programs, and interagency programs in support of conservation and solar energy objectives. To fulfill these responsibilities, three technical program offices under the Deputy Assistant Secretary have been created including the Office of SERI and RSEC programs, the Office of International Programs, and the Office of Interagency Programs.

INTRODUCTION

This paper will describe the Department of Energy (DOE) management approach for the solar and conservation activities emphasizing the role of the Solar Energy Research Institute (SERI), Regional Solar Energy Centers (RSEC's) and Solar International Programs. It will describe how these diverse activities are brought together using a management approach which is similar to the NASA model that has proved successful in directing a diverse range of technology activities.

Management Approach

Overall direction and planning for an integrated national solar and conservation program is accomplished at the DOE Headquarters level with program and project management decentralized to lead field offices and lead technical centers. The objectives of decentralization is to use research centers of technological excellence. Field operations offices, national laboratories, SERI and regional solar centers, universities, private industry and other Federal agencies contribute to a consolidated national program.

The responsibility of DOE Headquarters is to develop policy and long-range plans and to establish priorities to ensure coherent goal-oriented programs relevant to the National Energy Plan and legislative mandates. In addition, efforts are directed toward the development of the DOE budget, presentation of DOE programs to Congress, assessment of programs to meet goals and objectives, and coordination among key participants in the solar energy program.

Programs are being decentralized at three levels: subprograms, major elements of subprograms and projects. Day-to-day decentralized management is the responsibility of operations offices, national laboratories, including SERI, regional solar centers, other Federal agencies or a combination of key participants. The role of the "field" which has been assigned a decentralized program or project is to manage resources to accomplish a given objective within prescribed funding, performance and schedule constraints, and to report progress to Headquarters.

The headquarters organization that has been developed to manage the solar and conservation program is shown in Figure 1. The organization features both functional offices and an institutional office, the Deputy Assistant Secretary for Field Operations and International programs which is the office that I head. It should be pointed out that this organization combines solar and conservation functions that were previously under an Assistant Secretary for Energy Technology (ASET) and the Assistant Secretary for Conservation and Solar Applications (ASCS).

Participants in Federal Solar Program

Table 1 presents the breadth of key participants in the solar program. Decentralization of program and project management is developing key centers of expertise in the field among a varied mix of performers, which are geographically dispersed throughout the country. Program Managers in Headquarters have an oversight and planning responsibility for the solar technologies. Field offices have a day-to-day management responsibility, providing support to technical groups at the field office, in onsite project offices and at national laboratories. Contracts to industry and universities are awarded and managed by the field office as well as by the national laboratories. Laboratories with management responsibility for solar technologies have broadened their scope from performing inhouse R&D to becoming lead technology centers with the charter to coordinate and integrate a spectrum of activities. Other Federal agencies, many of whom have been involved in solar areas, are bringing their experience to bear in each of the solar technologies.

Each of the participants, as well as state and local governments, supports major efforts in industry, universities and non-profit groups. The Nation's colleges and universities are significant resources in the solar program, involved in basic and applied research, exploratory and technology development, systems design and testing and economic and social analysis. The commitment to colleges and universities in solar research and development is reinforced by the establishment of a specific university research program at SERI to stimulate basic and fundamental solar-related research.

General functions of key Solar Program participants are:

DOE Headquarters
- Planning
- Policy development
- Program development and coordination
- Fiscal control
- Evaluation of program results

DOE Regional and Field Offices
- Management of fiscal outlays
- Management support
- Project management

Federal Agencies
- Joint program management
- Technical support
- Support initial market entry through purchases and incentives

Solar Energy Research Institute
- In-house research and development
- National market development support
- Management support
- Technical support
- Project management

Regional Solar Energy Centers
- Regional market development support
- Outreach and information
- State and local government coordination
- Project management
- Technical support
- Evaluation of program results

National Laboratories
- Technical support
- Project management
- In-house research and development
- Evaluation of program results

State and Local Agencies
- Outreach
- Legislation
- Regulation
- Policy guidance
- Implementation of legislated programs

The Solar Energy Program involves a large number of universities, members of private industry, and research institutions.

SOLAR ENERGY RESEARCH INSTITUTE (SERI)

In the fall of 1974, Congress passed several pieces of legislation directed at the energy problem. Among these were two acts which outlined a national solar energy research and development program: PL 93-473, the National Solar Energy Research and Development Act of 1973; and PL 93-409, the National Solar Heating and Cooling Demonstration Act. The formation of the Energy Research and Development Administration (ERDA) in 1975 unified solar energy research efforts supported by the National Science Foundation, the National Aeronautics and Space Administration and the Department of Housing and Urban Development. These efforts became a part of a Federal solar research activity which was directed by Congress to establish a national Solar Energy Research Institute (SERI).

SERI formally came into being on July 5, 1977, with a startup staff of 50. Initially, SERI management reported to the Director of the Division of Solar Energy, ERDA. With the creation of the DOE in October of 1977, SERI reporting was assigned to the Assistant Secretary for Energy Technology (ASET) and the four RSEC's were assigned to report to the Assistant Secretary for Conservation and Solar Applications (ASCS).

At the present, SERI reports to the Assistant Secretary for Conservation and Solar Energy and has grown to over 700 employees. Their major activities are R&D, R&D contract management, analysis of issues associated with increasing utilization of solar energy, and responsibility for the solar energy information data bank. The anticipated FY 1980 SERI budget from all sources is on the order of $120 million (including funds provided for subcontracting to others).

In accordance with its mandate, SERI is to provide the nation with a center of excellence dedicated to serving the needs of the public and industry in the development of solar energy as a major alternative energy source. SERI is an integral part of the Conservation and Solar Program. It has established continuing programs in research, analysis, and assessment; information and education; technology transfer; and commercialization in cooperation with other efforts on a national and international basis. This institute is necessary to accommodate these continuing programs by physically providing the environment for such research, data accumulation, and interaction of the management, scientific researchers, and staff.

The major research and development areas presently underway at SERI are:

- Photovoltaic Systems
- Biomass Energy Systems
- Wind Energy Systems
- Solar Thermal Technology
- Ocean Energy Systems
- Active Solar Heating and Cooling
- Passive Solar Technology
- Industrial Process Heat
- Solar Energy Storage
- Advanced Solar Energy Research

Other areas of work include:

- Planning Analysis and Social Science
- Information Systems
- International Programs Coordination
- Academic and University Research Program
- Commercialization Activities

Funding

SERI operations were initiated in FY 1978 with a budget of approximately $7 million. Of the total funds provided to SERI for FY 1980, approximately $44 million will be used internally to support research, commercialization, and information activities. The remaining 68 million will be used to support subcontracted research activities. Through subcontracts, SERI acts as the manager of a significant fraction of the DOE solar budget, operating within the framework of the DOE decentralized management structure. A summary of the SERI FY 80 budget is shown in the attached Table 2.

Permanent Facility

$3 million was provided in FY 1979 for the design work of a permanent facility for SERI. Preliminary site design work, currently being reviewed by DOE headquarters, should be completed in 1980. A definitive cost and schedule for the project has not yet been established although a current estimate of the total cost is $98.5 million.

Future Directions

During its first two years of operation SERI has moved rapidly to establish itself as a center of excellence for solar energy research and information. An energetic staff has been assembled and, given proper guidance, they will be able to form the nucleus of a high quality national laboratory in the DOE tradition.

This is not to say that these first two years have been trouble free. As with any new organization of this type, with broad charter but no prior history, start-up difficulties were to be expected. The role of SERI vis-a-vis the overall DOE solar program had to be established. The need to incorporate this new entity into ongoing efforts meant that some dislocations would be experienced. These have now been largely resolved as DOE and SERI have sorted out their respective roles in support of the national solar program.

REGIONAL SOLAR ENERGY CENTERS

Recognizing the regionally diverse nature of solar energy applications, ERDA announced its intent to establish four regional solar energy centers (RSEC). Subsequently, organizations representing the northeastern, north central, western, and southern regions of the U.S. were awarded planning grants to promote the widespread use of solar energy.

The regional centers concentrate on commercialization of solar applications. Commercialization includes those activities that will bridge the gap between successful solar technology demonstrations and widespread use of these technologies by both the public and private sectors. These activities are designed to provide a secure and permanent market for the solar industry, to reduce buyer uncertainty, and to accelerate the use of solar technologies.

The centers are located in Boston, Massachusetts (Northeast Solar Energy Center); Atlanta, Georgia (Southern Solar Energy Center); Minneapolis, Minnesota (Mid-American Solar Energy Center); and Portland, Oregon (Western Solar Utilization Network). Figure 2 shows the regional jurisdiction of each center.

Scope of Activities

The market development activities of the regional centers are aimed at identifying and removing institutional and other barriers to solar energy use by encouraging state and local governments to establish appropriate standards, codes, regulations, and incentives through education and technician training programs, technical and marketing assistance efforts for businesses, and consumer awareness campaigns. Programs are designed and funded to permit the federal government to work together with the key constituencies who can make solar energy happen for the nation: manufacturers, designers and architects, builders, installers, financial officers, state and local government officials, public utility commissioners, and consumers. Programs now structured to emphasize those solar technologies that have reached or are near market-readiness: passive solar design, solar water heating, industrial process heat, small wind and wood combustion.

Each regional center maintains a state solar office network to help in achieving program goals. This kind of a network is an important outreach component of the regional center concept. Each state solar office functions independently and reflects the needs of its own state, but at the same time, contact with the regional center ensures that the states are included in the center's programs and objectives. These programs allow each center to track state solar legislation, keep current on utility and regulatory activities impacting solar, and be aware of solar programmatic activity at the state and local levels and of the response by state and local governments to federal solar initiatives. Efforts are made to establish working relationships with key individuals and groups at the state and local government levels. Through the regional centers, the states are involved in DOE's solar consumer assurance planning, identification of solar consumer problems, and other DOE programs aimed at removing institutional barriers to solar acceptance such as the development of model solar building codes for use by States and localities.

Status

The four regional centers are under 5-year (1979-1984) operating contracts with DOE. Funding and staff levels and activities are established for each fiscal year. Funding and staff levels for regional centers are summarized in Table 3.

Each regional center is governed by a Board of Directors with an appointment to the Board by each of the state governors in the respective regions. In addition, the centers have advisory groups that assist the regional center staff in planning and program development. State solar offices work directly with state and local governments to promote solar energy use. The regional centers are able to identify and implement activities that are tailored to the specific needs of each region, as well as to DOE's national solar energy program.

INTERNATIONAL SOLAR PROGRAMS

Nations around the world are increasingly looking to international energy cooperative activities in their search for viable energy supply alternatives. A principal reason for this trend is the increasing global problems with the cost and supply of petroleum fuels for economic development and national security. The widespread availability of solar energy resources over a large part of the most populated areas of the earth is leading other nations to develop solar plans, to undertake solar development programs, and to seek cooperation in solar research, development, and implementation activities.

The United States, among the nations of the world, has undertaken the largest and most aggressive national solar research, development, and demonstration program. Because of this commitment and progress, many nations are interested in receiving information and assistance in their own efforts to evaluate and use their solar energy resources. In addition, the U.S. experience in implementing solar energy-based systems commercially can have widespread ramifications for other national efforts, as well as for the international availability of reliable solar energy systems.

The U.S. solar program has been organized and growing rapidly since 1971, well before the oil embargo in late 1973. It is larger than the combined programs of all of the other nations in the world. The United States is fortunate to be one of the few, highly industrialized countries in the world to have substantial solar resources that are capable of providing a significant amount of its total energy needs.

A presidential goal of 20% solar-derived energy usage in the United States by the year 2000, was set in 1979 on the basis of the Domestic Policy Review of Solar Energy.* In addition to a greater emphasis on development of solar energy technology for domestic energy needs, this report recommended a growing U.S. effort in international cooperation to enhance U.S. technological progress and to assist other countries in the utilization of their solar resources.

The conclusions from the International Panel's Final Report to the Domestic Policy Review are summarized as follows:

The United States should:

- o encourage the global transition from depletable petroleum supplies to alternative, renewable sources of energy,
- o make energy an area of international cooperation,
- o contribute to the economic and social advancement of developing countries by reducing energy-related obstacles,
- o advance the state of U.S. technical energy programs,
- o encourage the international use of alternative energy technologies developed by U.S. industry,
- o avoid premature or excessive commitments to the use of nuclear energy, and
- o promote appropriate bilateral and multilateral scientific and technical cooperation.

As a consequence of the U.S. Department of Energy's (DOE) mission to implement U.S. energy policy, the management of U.S. international cooperative activities in solar energy research, development, and demonstration is generally recognized to be a DOE responsibility. International agreements are developed and implemented in conjunction with the U.S. Department of State as the responsible overview government organization for all U.S. government overseas policies, actions, and agreements. Within DOE, the implementation of international solar activities is coordinated by offices reporting to the DOE Assistant Secretary for International Affairs and managed by offices and laboratories reporting to the DOE Assistant Secretary for Conservation and Solar Energy.

In general, international cooperative activities of a technical nature originate in one of three ways: (1) in response to initiatives from foreign governments or other groups abroad; (2) as the result of high-level commitments of the administration; or (3) as the result of needs and opportunities identified by programmatic or policy elements within DOE. Some international solar agreements have been active since 1974, before the formation of either DOE or its predecessor organization, the U.S. Energy Research and Development Administration.

Goals and Purpose

DOE undertakes international solar activities to advance U.S. solar technology development, enhance the capabilities of U.S. industry, and assist other countries in finding alternatives to the use of oil in their countries. More specific goals are listed below:

- o to increase U.S. technical capabilities through international technical cooperative activities,
- o to strengthen the U.S. industry through increased exports and other activities, and
- o to reduce the worldwide energy demand for oil and fossil fuel.

The Department of Energy is the lead U.S. agency in undertaking major cooperative solar activities with international organizations such as the International Energy Agency, NATO's Committee on the Challenges of Modern Society, the World Bank and the United Nations. These international organizations coordinate multi-national efforts in information exchanges, conferences, surveys, research and development projects, application studies, and selected system demonstrations. Current

*International Panel. Domestic Policy Review of Solar Energy, Final Report: Volume 1. October 1978, p. 5

areas of cooperation include information exchanges in biomass and wind technology areas; research and development projects in solar heating and cooling; thermal electric power, and wavepower; and conferences directed to the needs of developing countries.

One of the major cooperative projects under the International Energy Agency involves the construction and operation of two experimental 500 kWe solar thermal electric plants in Spain. One plant employs central receiver technology while the other utilizes distributed received technology. The design phase has been completed, and the construction phase is underway with initial operation of both plants scheduled for 1981. Ten countries are cooperating in the funding of this $45 million project. Artists' sketches of these projects are shown as Figures 3 and 4.

The Department of Energy has also been the lead U.S. agency in negotiating and carrying out bilateral solar energy agreements with many countries. The United States-Saudi Arabia Joint Solar Energy Project is the largest U.S. commitment to this type of international solar cooperation. Both countries will contribute $50 million over a 5-year period in a $100 million effort to advance the development and dissemination of solar energy technology. Major program areas include urban, rural/agricultural, and industrial solar applications. A major project in the rural/agricultural program area is a solar village power system to be built near two remotely located Saudi Arabian villages. This 350 kWe system using photovoltaic technology provides an opportunity to demonstrate new technology in the environment of a developing country. It will be in operation in mid-1982.

There are a number of other bilateral solar agreements in effect and several others in various stages of negotiations. Bilateral agreements for information exchange have been in operation for a number of years with France, Japan, USSR, and Spain. Bilateral agreements have recently been initiated with Italy and Mexico, and involve demonstration of solar systems in each of those countries. Other agreements are being negotiated for information exchange and cooperative projects.

While cooperative efforts with industrialized countries usually involve sharing technologies and expertise, the approach to working with developing countries is different. Since developing countries usually have not committed themselves to a broad, national, conventional energy base, they can pursue a development path that promises to meet their per-capita energy-consumption goals while at the same time providing for long-term reliability, increased self-sufficiency, and improved environmental quality.

The most immediate overseas market appears to be relatively small, onsite solar technologies. Many development experts believe that decentralized solar technologies (e.g. small photovoltaics systems) can now economically provide many of the power needs for water pumping, communications, educational TV, and off-grid village power. In the near future, a market should develop for exports of specialty hardware and services; sale of system designs, engineering and advanced technology under licensing, and royalty or joint-venture agreements.

In developing countries, there are large areas where there is no access to power grids. In other areas where electricity is generated, costs are often very high. As a result, commercial application of solar electric technologies in developing countries could be possible earlier on an economic basis than in the United States. There is a specific need in developing countries for low-cost, reliable easily maintainable systems that do not require the construction of expensive transmission lines. Pilot testing of U.S. decentralized, renewable systems in these countries can be a preliminary step in improving the quality of life for large numbers of isolated villages around the world and in assisting U.S. industrial efforts to serve those needs with U.S.-developed technology.

Budget

The President's FY 1981 budget request for DOE includes line items totalling $15 million for solar international activities under the Assistant Secretary for Conservation and Solar Energy.

These line-item funds would cover most of the firm commitments as of early 1979, of which the largest commitment is for the United States/Saudi Arabia Solar Agreement (approximately 80% of the total). The remaining funds are committed to agreements with the International Energy Agency and to the support of international activities at SERI. Some other program funds will be needed to continue a number of other existing bilateral agreements;e.g., Israel, Italy, and Mexico.

INSTITUTIONAL MANAGEMENT

The Office of the Deputy Assistant Secretary for Field Operations and International Programs (Figure 5) was established to provide the institutional perspective for conservation and solar programs. The program offices for the different technologies and activities are oriented to meeting their particular program objectives. In order to maintain an agency view, it is necessary to maintain an overall perspective of what the supporting organizations such as SERI and NASA are being requested to accomplish. This requires an overall understanding of the organizational capability and resources combined with an understanding of DOE management priorities. This involves assuring that the necessary facilities and personnel are in place to meet the long-term programmatic needs of DOE. For example, DOE has a major effort at NASA-Lewis involving wind energy, energy storage, magneto hydro-dynamics, electric automobiles, Sterling engines, turbine engines and photovoltaic activities. NASA has limited the number of personnel to be provided in support of the DOE programs. Thus decisions have to be made with Lewis Research Center support on how their limited personnel resources are allocated to the various programs. The same situation prevails at SERI and many of the other field support organizations. A major function of this new office is to assure that the institutional resources are correlated with DOE management objectives.

The office is designed to surface and deal with the broad management problems that involve a wider scope than the individual program or project. It provides a mechanism for resolving program, agency and facility issues that arise. As in NASA, there is both a program and an institutional perspective provided to the DOE key management officials.

The Field Operations and International Programs office provides a similar function in the international sphere. The individual projects are managed by their respective program office while the national objectives are correlated with the projects by this office. This requires the integrated management of all the international solar and conservation activities.

Conclusion

The complexity of the DOE solar and conservation activities provide a unique management challenge. The evolution of the DOE organization to meet this challenge has incorporated many of the lessons learned from managing Department of Defense and NASA programs but incorporates many factors such as the social and public aspects which are not prevalent in DOE or NASA activities. The DOE solar and conservation activities have been described in the context of the management system and means of utilization of national resources to conduct these activities to meet our national objectives.

FIGURE I

Organization Chart

CONSERVATION AND SOLAR ENERGY

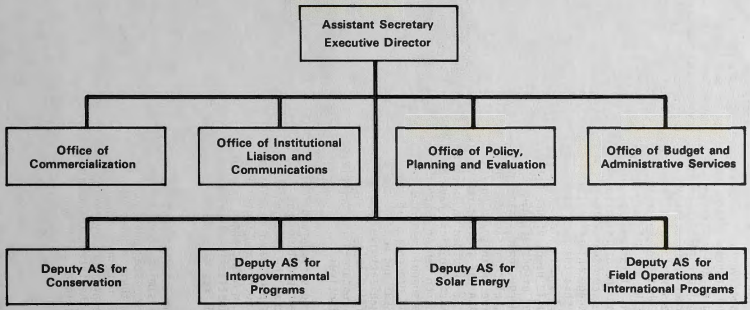

TABLE I

Major Participating Organizations in the Solar Program

PARTICIPANT TYPE	SOLAR TECHNOLOGY/APPLICATIONS PROGRAM							
	SOLAR THERMAL POWER	PHOTOVOLTAICS	BIOMASS & WOOD ENERGY	WIND ENERGY	OCEAN SYSTEMS	ACTIVE HEATING & COOLING	PASSIVE & HYBRID HEATING & COOLING	AGRICULTURAL, INDUSTRIAL, PROCESS HEAT
DOE *Headquarters*	ST	ST SA	ST SA	ST SA	ST	SA	SA	SA
DOE Field Offices	SAN CHO ALO	SAN CHO ALO ORO	CHO RLO SAN	SAN CHO ALO RLO	CHO SAN	SAN CHO ALO	SAN CHO ALO	SAN CHO ALO ORO
Other Federal Agencies	NASA	NASA TVA BPA DOD DOI AID DOS	DOD NBS TVA BPA USDA	NASA TVA NBS DOD GSA USDA BPA DOI DOS	NOAA MARAD	NASA TVA CPSC NBS HUD AID USDA DOD GSA DOC DOS SBA HEW VA DOL DOI	HUD USDA NBS GSA NEA	USDA NASA NBS USAF
Solar Energy Research Institute (SERI)	√	√	√	√	√	√	√	√
Regional Solar Energy Centers			√	√		√	√	√
National Laboratories	SLA SLL	ANL BNL LBL LASL ORNL SLA PNL	ANL BNL LBL PNL ORNL	LLL PNL SLA RF	ANL LBL ORNL	ANL BNL LBL LASL	ANL BNL LBL LASL ORNL	SLA ORNL LLL LASL INEL ANL

√ Denotes participation in the above program.

AID Agency for International Development
ALO Albuquerque Operations Office
ANL Argonne National Laboratory
BIA Bureau of Indian Affairs
BLM Bureau of Land Management
BNL Brookhaven National Laboratory
BPA Bonneville Power Administration
CHO Chicago Operations Office
CPSC Consumer Product Safety Commission
DOC Department of Commerce
DOD Department of Defense
DOE Department of Energy
DOI Department of Interior
DOL Department of Labor
DOS Department of State
EDA Economic Development Administration
EPA Environmental Protection Agency
FTC Federal Trade Commission
GSA General Services Administration
HEW Health, Education and Welfare
HUD Department of Housing and Urban Development
INEL Idaho National Engineering Laboratory
LASL Los Alamos Scientific Laboratory
LBL Lawrence Berkeley Laboratory
LLL Lawrence Livermore Laboratory
MARAD Maritime Administration
NASA National Aeronautics and Space Administration
NBS National Bureau of Standards
NEA National Endowment for the Arts
NOAA National Oceanic and Atmospheric Administration
ORNL Oak Ridge National Laboratory
ORO Oak Ridge Operations Office
PNL Pacific Northwest National Laboratory
RF Rocky Flats SWECS Testing and Development Center
RLO Richlands Operations Office
RSECs Regional Solar Energy Centers
(Mid American Solar Energy Complex)
(Western Solar Utilization Network)
(Southern Solar Energy Center)
(Northeast Solar Energy Center)
SA Office of Solar Applications
SAN San Francisco Operations Office
SBA Small Business Administration
SERI Solar Energy Research Institute
SLA Sandia Laboratory Albuquerque
SLL Sandia Laboratory Livermore
ST Office of Solar Technology
TVA Tennessee Valley Authority
USAF United States Air Force
USDA United States Department of Agriculture
VA Veterans Administration

TABLE 2

SERI—FY1980 PROGRAM

PROGRAM ELEMENTS	PROPOSED EXPENDITURES
Biomass	$ 18,343,4000
Ocean Systems	5,080,000
PV	48,808,000
Thermal	13,457,000
Wind	7,495,000
Energy Storage	1,000,000
Systems Development	8,268,000
Buildings	2,206,000
Agriculture & Industrial Process Heat	1,410,000
Market Development and Training	2,899,000
Federal Buildings Program	200,000
Commercialization	1,150,000
Building and Community Systems	725,000
Overview and Assessment	60,000
Structure and Materials	250,000
Photochemical and Radiation	320,000
Exploratory Energy Concepts	188,000
Biological Energy Conversion and Conservation	117,000
TOTAL	$111,976,400

FIGURE 2

Geographic Responsibilities of the Regional Solar Energy Centers: Geographic Areas

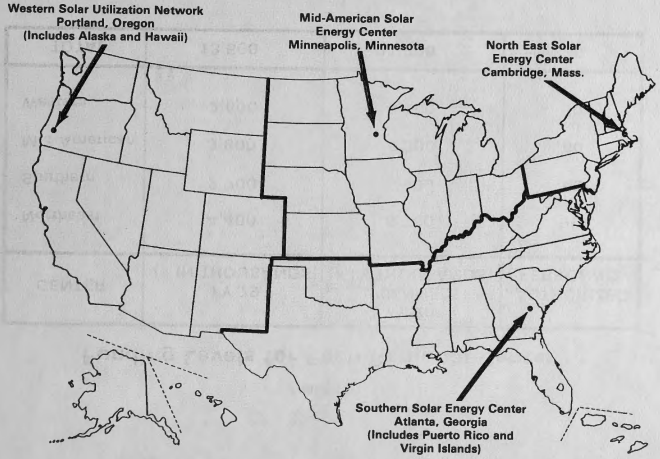

TABLE 3

Funding Levels for Each Regional Center

CENTER	FY 79 ($ IN THOUSANDS)	FY 80 (PLANNED) ($ IN THOUSANDS)	AUTHORIZED PERSONNEL
Northeast	4,400	5,700	90
Southern	2,700	5,600	55
Mid-American	3,800	5,300	60
Western	2,600	5,100	30
TOTAL	13,500	21,700	235

FIGURE 3

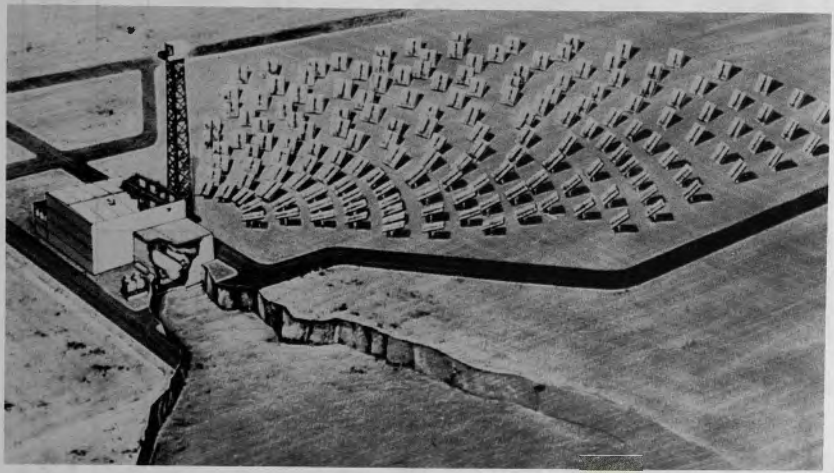

FIGURE 4

FIGURE 5